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MECHANIZED COAL MINING BY THE ROOM-AND-PILLAR SYSTEM

I. F. Lykov

In 1948, experiments were conducted in Section No 10 of the Mine imeni Kirov (Vostsibugol' Combine) in the use of room-and-pillar system of mining the lower layer of the "Glavnyy" seam of the Cheremkhovo coal deposit, with mechanized cutting, loading, and conveying processes.

The thickness of the "Glavnyy" seam varies from 7.5 to 8.0 meters. It has a dip of from 0 to 2 degrees. The seam undulates slightly and its structure is relatively uniform. It contains up to 10 rock layers and two seams are being worked. The upper seam of section No 10 was worked to a depth of 1.7 to 2.2 meters by the longwall system in 1946. The lower seam is now being worked by the room-and-pillar system. The thickness of this seam is 2.5 to 3.5 meters. A strip of coal 1.5 to 2.0 meters thick is left between the upper and lower layers. This includes rock layers with a total thickness of 60 cubic meters which constitute the immediate roof over the lower seam. These rocks consist mainly of argillite rock which is not liable to deteriorate.

There are one to 4 rock layers in the lower seam. Their thickness is not uniform and sometimes they disappear completely. These layers are made up of carbonaceous shale, clay, and an exceedingly strong "slab" of fine grained, clayey sandstone, which is firmly cemented together and does not yield easily to the cutter. These rock formations are easily separated from the coal.

The floor of the seam is made up of a brecciated conglomerate. Sometimes seepage, mainly from ground water, is observed in mining the section.

There is not much gas in the mine but the quantity of dust makes operations dangerous.

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Section No 10 was converted to the room-and-pillar system of mining on 15 October 1947, after an unsuccessful attempt was made to mine the lower layer of the seam by the longwall system. This latter system was abandoned because of the heavy pressure of the rock roof which was disturbed by mining operations in cutting the upper layer of the seam.

On 1 April 1948, when the experimental work was begun, the section contained four rooms and two inter-room pillars. The total face area consisted of 22 meters, of which 14 meters (4 by 3.5 meters) was in rooms and 8 meters (2 by 4 meters) was in inter-room pillars. The equipment consisted of 5 ST-11 scraper conveyors, 2 S-153 loading machines, one RTU-30 belt conveyor, and 3 ER-5 electric drills.

The coal was broken down by explosives without previous cutting. The bore holes were 1.5 to 1.7 meters deep. Penetration into the working face did not exceed 1.5 meters per cycle. The two S-153 loading machines in the section serviced only two of the four rooms. Not more than 18 to 20 percent of the coal was mechanically loaded.

The faces of these rooms and inter-room pillars yielded a low output. Coal extraction from the rooms did not exceed 20 tons per cycle. Under such a condition, it was impossible to achieve good technical-economic indexes.

In an effort to raise labor productivity in section No 10, a brigade of VUGI (All-Union Coal Institute) workers suggested a new plan. This plan provided for conversion to the three-room system of mining, and the utilization of the VTU-1 universal cutting machine and the S-153 loading machines. These machines were to be transferred from face to face.

The three-room system of mining produced positive results, both from the standpoint of the full exploitation of the mining face and in the efficient utilization of face machinery. Geological conditions, as well as experiments, proved that the most expedient room width was 6 meters, room length 70 meters, inter-room pillar width 5 meters, room height 3.0 to 3.5 meters. When the inter-room pillars were mined, roof stoping was done in 6- to 8-meter sections.

At the completion of the experimental work on 15 September 1948, the mechanized section No 10 had a total mining face of 33 meters, of which 18 meters (3 by 6 meters) were in rooms and 15 meters (3 by 5 meters) were in the inter-room pillars.

The following machines were used in this project: one VTU-1 universal cutting machine, 2 S-153 loading machines, 8 ST-11 scraper conveyors, one RTU-30 belt conveyor, and 4 ER-5 electric drills. The total power consumption of these machines was 225 kilowatts. They were supplied with electricity from the section power plant which had a capacity of 220 kilovolt amperes and a voltage of 6,000/380.

The working face of the three rooms were serviced by a VTU-1 cutting machine and a S-153 loading machine. Three faces of the inter-room pillars were serviced by a second S-153 loading machine. A special "Springboard" design of the VUGI was used to transfer the cutting and loading machines from face to face, across the ST-11 scraper conveyor, without having to shut down the latter. The VTU-1 and S-153, which have chain treads, can be moved 100 to 110 meters in 12 to 15 minutes when these spring boards are used. This time includes crossing over two conveyors and two turns in the drift.

After this experimental section had been completely equipped in the latter part of June 1948, coal production increased to 435 to 440 tons, and on some days this figure even reached 475 to 554 tons. The average daily coal production for the first half of September 1948 was 456 tons. This is 247 tons more than the average daily production from the face in September 1947.

In September 1947, coal production in the section was 2.6 tons per worker; in March 1948, at the start of experimental work, this figure was 5.5 tons. During the experimental period, production rose to 6 to 8 tons per worker; in the first half of September 1948 to 8.2 tons; and on some days during September, 8.3, 8.9, and even 10.3 tons per worker. Some brigades attained a production of between 10 and 11 tons.

Utilization of the VTU-1 universal cutting machine and the S-153 loading machines at the working face (in the room-and-pillar mining system) is responsible for such increases in coal extraction and labor productivity. The VTU-1 universal cutting machine was brought into the experimental section 26 May 1948. During the rest of May, cuttings were done in five faces of the rooms; 31 in June, 35 in July, 48 in August and in 42 faces during the first 15 days of September; 15 faces of the latter were made from 10 through 15 September, a daily average of 3.2 faces.

Production of the S-153 loading machine also improved from month to month. This machine loaded coal at 134 faces (both in rooms and inter-room pillars) in July, 146 in August, 70 in the first 10 days of September, and 42 from 10 through 15 September. This is an average of 8.4 faces per 24-hour period.

By using the cutting machine, an average of 55 to 60 tons of coal were extracted from one room (without cutting, this figure was not more than 35 to 40 tons). The average coal yield from the working faces of the rooms and inter-room pillars varied from 45 to 50 tons. Consequently, 8.4 times 48, or about 400 tons of coal were loaded by machine per 24 hours. When the daily average coal production in the section was 456 tons, 87 percent of the coal was loaded by machine and only 13 percent was loaded by hand. Loading by hand is necessary when the passages between rooms are cut, when new rooms are cut, when the coal over the pillars is cleaned up, and when the coal is cleaned up around the working face.

Increasing the width of the room from 3.5 to 6 meters, utilizing the VTU-1 cutting machine, and solving the question of servicing three faces with one machine improves the indexes of the mechanized experimental section. Production costs per ton of coal are 20 to 25 percent lower than in the longwall section.

Indexes of average daily coal production and shift labor productivity in the section do not represent the possible limit. Data on timing observations show that the VTU-1 cutting machine is utilized only 29 percent of the time, the S-153 loading machine 47 percent, and the conveyor 67 percent.

In spite of the fact that there are still many technical and organizational defects in the mechanized section No 10, indexes there have shown considerable improvement in a relatively short period. These indexes are considerably higher than those of any mine operating under the longwall system and they indicate that the room-and-pillar system of mining, based on mechanization of labor-consuming operations, can be widely applied in the Cheremkhovo coal deposit.

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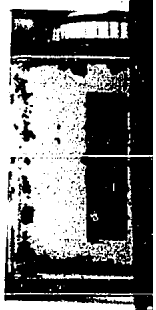

	Sep 1947 Longwall System	Mar 1948 Beginning of Experimental Work	Sep 1948 Completion of Experimental Work
Average daily production (tons)	209	303	456
Shift production per worker in section (tons)	2.6	5.5	8.2
Amount coal extracted from rooms per cycle (tons)	faces (lavy)	20	60
Average amount of coal loaded mechanically per 24 hours	loaded by hand	60	400
Percentage of mechanized loading	--	20	87
Average daily production of S-153 loading machine (tons)	none	30	200
Consumption of mine timber (cu m per 1,000 tons)	55	19	19
Mining of coal losses by area (in %)	--	23	8*

*for August 1948

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